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10/528,661	03/22/2005	Eiji Oyaizu	017447-0188	7024

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EXAMINER	
ROSENBERGER, FREDERICK F	
ART UNIT	PAPER NUMBER
2884	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/528,661	OYAIZU ET AL.	
	Examiner	Art Unit	
	Frederick F. Rosenberger	2884	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 March 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5,8,9,11,13,14,18 and 20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5,8,9,11,13,14,18 and 20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *22 March 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicant's reply, filed 22 March 2007, has been received and entered. Accordingly, changes have been made to specification. Claims 1-3, 5, 8, 9, 11, 13, and 18 have been amended. Claims 6, 7, 10, 12, 15-17, and 19 have been cancelled. Claim 20 has been added. Thus, claims 1-3, 5, 8, 9, 11, 13, and 18 are currently pending in this application.

2. Applicant's amendment of the claims has successfully overcome the objections to claims 1, 7, 13, and 16, as detailed in paragraph 3 of the previous Office action.

3. Applicant's amendment of claims 1 and 11 has successfully overcome the double-patenting rejection of claims 1-4, 11-14, and 18, as detailed in paragraph 12 of the previous Office action.

Response to Arguments

4. Applicant's arguments filed 22 March 2007 have been fully considered but they are not persuasive.

Applicant has amended claim 1 to include part of the limitations of original claims 5-7. Applicant has amended claim 11 to be independent and to include part of the limitations of original claims 7 and 12. As such, the pertinent rejection of the new

independent claims is the 103(a) rejection based on Takahara in view of Sato, Tran, and Okumura.

Applicant essentially argues with respect to the pertinent rejection that none Takahara, Sato, of Tran teach the claimed surface roughness for the phosphor layer (see pages 7-8). The examiner agrees with this assessment; however, it is the inclusion of Okumura et al. that provides the surface roughness limitations to the combination. The applicant does not contest that the combination of Takahara, Sato, and Tran discloses all the limitations of the claim absent the surface roughness limitations.

With respect to Okumura et al., applicant primarily argues that Okumura teaches a surface roughness between 0.01μm and 0.8μm for a sintered body and not a phosphor layer produced by drying a liquid solution, as taught by Takahara (see bottom of page 8 through bottom of page 9). As such, applicant alleges that the teaching of Okumura would be incompatible with the teachings of Takahara (see bottom of page 9). Applicant further alleges that the combination of Okumura and Takahara would result in a sintered body not formed on a support having a sheet shape.

The examiner respectfully disagrees with this assessment. Okumura is relied upon for its teaching regarding the coupling of a rare-earth oxysulfide phosphor layer with a photodiode or other photosensor. In such case, Okumura teaches that surface roughness of the scintillating phosphor layer should be between 0.01μm and 0.8μm in order to improve the matching characteristic between the phosphor layer and the photodiode, thereby improving the optical output characteristic (column 3, lines 29-39).

The teachings provided by Okumura would extend to any type of phosphor coupled with a photodiode, regardless of the method of fabrication, since the optical characteristics are a direct product of the phosphor layer surface (column 6, lines 23-33). One of ordinary skill in the art would have known that making a reduced surface roughness in drying a phosphor layer on a support would have resulted in improved optical coupling characteristics for the phosphor.

Since the teachings would be equally applicable regardless of the fabrication method, the examiner disagrees that the combination of Takahara and Okumura would result in a sintered body instead of a phosphor on a support having a sheet shape. Rather, the examiner maintains that given the phosphor on a support of Takahara and the surface roughness teaching regarding the coupling of a phosphor to a photodiode of Okumura, it would have been obvious for one of ordinary skill in the art to arrive at the claimed invention.

The examiner believes the rejections of pending claims 1-5, 8, 9, 11, 13, 14, 18, and 20 to be proper. As such, the rejections are maintained.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 1-5, 8, 11, 13, 14, 18, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takahara et al. (US Patent # 6,392,248) in view of Sato et al. (US Patent # 6,429,430), Tran et al. (US Patent # 5,545,899), and Okumura et al. (US Patent # 6,384,417).

With regards to claims 1-4 and 8, Takahara et al. disclose a phosphor sheet for a radiation detector comprising:

A support **6** (Figure 3) having a sheet shape;

A phosphor layer **7** (Figure 3) provided on the support **6**, wherein the phosphor layer emits light in response to incident X-rays (column 7, lines 37-43) and wherein the phosphor layer contains a europium activated gadolinium oxysulfide phosphor with the europium within the cited concentration range (column 17, lines 48-49) and the phosphor satisfying the cited formula (i.e. R=Gd and a=0.3).

However, Takahara et al. do not specifically disclose that the phosphor layer has a surface that is layered on the photoelectric conversion film. Instead, Takahara et al. provide the phosphor layer on a support with no mention of layering with a photoelectric conversion film.

Tran et al. teach a conventional X-ray detector employing a scintillating phosphor **16** (Figure 1), wherein the phosphor layer (gadolinium oxysulfide doped with europium) is layered on an array of photoelectric conversion modules **12**. Tran et al. teach that the phosphor is typically formed on the photoelectric device, thus obviating the need for the separate support disclosed by Takahara et al. However, Sato et al. teach that fabricating the phosphor on a separate support and then combining the phosphor with the photoelectric conversions device is advantageous (column 1, lines 46-52). As would be apparent to one of ordinary skill in the art, such a configuration allows for remote processing of each device without concern of fabrication compatibility issues.

Thus, it would have been obvious for a person having ordinary skill in the art at the time the invention was made to provide the phosphor on a support and layer the phosphor sheet on a photoelectric conversion device, so as to enable the device to be used as conventional X-ray detector while allowing remote processing of the different components, as taught by Tran et al. and Sato et al.

Further, Takahara et al. are also silent with regards to the surface of the phosphor layer having a surface roughness of less than 0.3μm in average roughness.

Okumura et al. disclose the use of a europium-activated gadolinium oxysulfide phosphor in an X-ray detector, wherein the phosphor is coupled to a photodiode

detector array (column 4, lines 20-25). Okumura et al. teach that in such a scenario it is beneficial to provide a surface roughness for the phosphor between 0.01μm and 0.8μm, so as to improve the matching characteristics of the phosphor with a photodiode, thereby improving the output characteristics of the phosphor (column 3, lines 32-38). Okumura et al. further disclose an example of surface roughness less than 0.3μm (column 8, lines 30-36).

Thus, it would have been obvious for a person having ordinary skill in the art at the time the invention was made to provide a surface roughness less than 0.3μm so as to improve the matching characteristics of the phosphor and photodiode thereby improving light output of the phosphor, as taught by Okumura et al.

With regards to claim 5, Takahara et al. further disclose the coated phosphor powder with average particle sizes of 2.0μm (column 17, lines 48-49).

With regards to claim 11, the combination of Takahara et al., Tran et al., Sato et al., and Okumura et al. as applied to claim 1 above discloses all the limitations of the phosphor sheet, as discussed above. Further, the combination suggests that the phosphor sheet may be used in a layered arrangement with a photoelectric conversion film, in the form of a photodiode layer **52**, for X-ray detection. In addition, Tran et al. teach the use of a TFT readout system, which is conventional in the art (for example, see US Patent # 6,791,091), for reading out the electric charges generated by the photodiodes in order to form an image signal (column 5, lines 23-31; column 6, lines 47-53). Thus, it would have been obvious for a person having ordinary skill in the art at the time the invention was made to employ a charge information reading section since such

systems are conventionally known for reading out image information from a detector array.

The combination doesn't specifically address the material for the photoelectric conversion film. However, amorphous silicon or single crystal silicon films are well known in the art as photodetectors (i.e. conversion of light energy into electrical signals). Thus, it would have been obvious for one having ordinary skill in the art at the time the invention was made to use amorphous silicon or single crystal silicon for the photoelectric conversion film, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

With regards to claim 13, Tran et al. further disclose that the TFT readout matrix comprises a charge storage capacitor **54** for storing the charge from the photodiode **52** and TFT switching elements **40**, **48**, **50** corresponding to each pixel for reading out the electric charges (column 5, lines 23-28).

With regards to claim 14, Tran et al. suggests that conventional X-ray detectors involve an array of pixel elements (column 1, lines 47-49).

With regards to claim 18, Takahara et al. suggests the use of the phosphor in a film based radiographic examination (Figure 2) while Tran et al. and Sato et al. suggest coupling the phosphor with a photoelectric conversion device, as addressed with respect to claim 11 above.

With regards to claim 20, Takahara et al. further disclose the coated phosphor powder with average particle sizes of 2.0μm (column 17, lines 48-49). As such,

Takahara et al. do not specifically address an average particle size between 6μm and 10μm. However, it would have been obvious for a person having ordinary skill in the art at the time the invention was made to choose an average particle size between 6μm and 10μm, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

8. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takahara et al., Sato et al., Tran et al., and Okumura et al., as applied to claim 1 above, and further in view of Ohara et al. (US Patent # 6,394,650)

The combination of Takahara et al., Sato et al., Tran et al., and Okumura et al. disclose all the limitations of parent claim 1, as discussed above. However, the combination is silent with regards to the range for the filling factor for the phosphor powder in the layer.

Ohara et al. discloses a gadolinium oxysulfide phosphor (column 9, line 27) for use in an X-ray imaging system, wherein the filling factor of the phosphor layer is greater than 60% for a particle size of 2μm to 7μm (column 6, lines 50-67). Ohara et al. further note that a reduced filling factor increases light scattering, resulting in reduced sharpness (column 19, lines 15-22).

Thus, it would have been obvious for a person having ordinary skill in the art at the time the invention was made to use a filling factor greater than 60% so as to decrease light scattering and improve image sharpness, as taught by Ohara et al. It

would have been further obvious to choose a filling factor less than 80%, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Frederick F. Rosenberger whose telephone number is

571-272-6107. The examiner can normally be reached on Monday - Friday with flexible hours.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Porta can be reached on 571-272-2444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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